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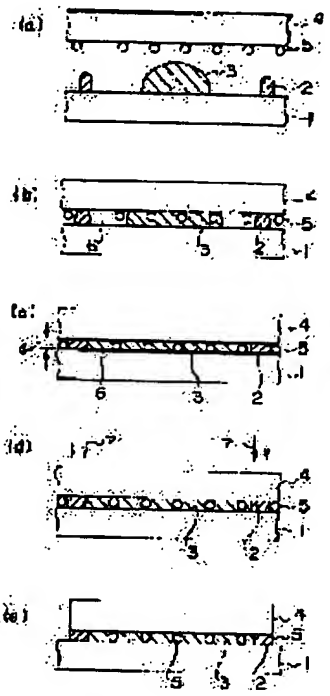
(54) PRODUCTION OF LIQUID CRYSTAL DISPLAY PANEL

(57)Abstract:
PURPOSE: To prevent a sealing defect by uniformly distributing spacers over the entire part of a liquid crystal panel at the time of sealing liquid crystals between substrates by a vacuum dropping method in the process for producing the liquid crystal display panel formed by dropping a liquid crystal material between the substrates and sealing the liquid crystal material between the substrates facing each other.
CONSTITUTION: The max. diameter of the spacers 5 adhered and fixed between a pair of the substrates 1 and 4 is smaller by at least 0.2 to 0.6μm than the thickness of the liquid crystal layer held between the substrates 1 and 4. The spacers 5 are coated with adhesives and the viscosity of the sealing material 2 for sealing the liquid crystals is specified to ≥50000cps.



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CLAIMS

[Claim(s)]

[Claim 1] The manufacture method of the liquid crystal display panel characterized by providing the following. The process which applies a sealant to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates of a couple. The process which makes the particle which has 0.2-0.6 micrometers or a path small 4 to 12% to the liquid crystal layer thickness which it is going to form and control between the substrates of the aforementioned couple adhere and fix to the field by the side of one electrode formation of the substrates of the aforementioned couple. The process which trickles liquid crystal material on the field by the side of the aforementioned electrode formation surrounded by the aforementioned sealant. The process which the field by the side of the one aforementioned pair of each electrode formation of a substrate is made to counter, piles up under reduced pressure, extends the aforementioned liquid crystal material, and forms the aforementioned liquid crystal layer between the substrates of the aforementioned couple.

[Claim 2] The aforementioned particle is the manufacture method of the liquid crystal display panel according to claim 1 characterized by being covered with adhesives and fixed to the field by the side of aforementioned one electrode formation.

[Claim 3] The manufacture method of the liquid crystal display panel characterized by providing the following. The process at which viscosity applies the sealant of 50000 or more cps to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates of a couple. The process which trickles liquid crystal material into the field by the side of the aforementioned electrode formation surrounded by the aforementioned sealant. The process which the field by the side of each electrode formation of the substrate of the aforementioned couple is made to counter, piles up under reduced pressure, extends the aforementioned liquid crystal material, and forms the aforementioned liquid crystal layer between the substrates of the aforementioned couple.

[Claim 4] The manufacture method of the liquid crystal display panel characterized by providing the following. The process which forms at least the frame which consists of a sealant doubly along this field on the field by the side of one [at least] electrode formation among the substrates of a couple. The process of the aforementioned sealant by the side of electrode formation of the aforementioned substrate which trickles liquid crystal material within the inside limit most. The process which the field by the side of each electrode formation of the substrate of the aforementioned couple is made to counter, piles up under reduced pressure, extends the aforementioned liquid crystal material, and forms the aforementioned liquid crystal layer between the substrates of the aforementioned couple.

[Claim 5] The manufacture method of the liquid crystal display panel according to claim 4 characterized by leaving and excising the No. 1 [at least] inside of the frames which consist at least one side of the substrate of the aforementioned couple of the aforementioned sealant after closing the aforementioned liquid crystal material.

[Claim 6] The manufacture method of the liquid crystal display panel characterized by providing the following. The process which trickles liquid crystal material into the field by the side of the aforementioned electrode formation surrounded by this frame that applies to the field by the side of one [at least] electrode formation of the substrates of a couple the frame which consists of an optical hardening type sealant, arranges a shading means near the inside of this frame, and consists of this sealant. The process which the field by the side of each electrode formation of the substrate of the aforementioned couple is made to counter, and is piled up under reduced pressure. The process which light is irradiated [process] at the aforementioned sealant and stiffens this sealant.

[Claim 7] The manufacture method of the liquid crystal panel according to claim 1, 3, 4, or 6 characterized by dropping the aforementioned liquid crystal material using the dispenser which has liquid crystal feed holes to the down side, and has the needle which is arranged in the liquid crystal material container with which an internal pressure is maintained uniformly, and this liquid crystal material container, and opens and closes these liquid crystal feed holes.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the manufacture method of the liquid crystal display panel which closes and forms liquid crystal material between the substrates which trickle liquid crystal material into a substrate and counter it in more detail about the manufacture method of a liquid crystal display panel.
[0002]
[Description of the Prior Art] The liquid crystal display is used in the latus field as display from points, like thickness is thinly lightweight and there is little power consumption. The liquid crystal panel for displaying the character and picture which are the principal part of a liquid crystal display has the first substrate in which the transparent electrode was formed, and the second substrate in which drive circuits, such as TFT, were formed, and liquid crystal material is enclosed among those substrates.
[0003] As a method of enclosing liquid crystal between the substrates of a couple, there are a vacuum pouring-in method and the vacuum dropping pouring-in method, for example. The vacuum pouring-in method piles up two substrates at intervals of predetermined on both sides of the closure member of the shape of a frame which has opening in part, and constitutes an empty cell. If put this empty cell into a chamber, and opening of an empty cell is continuously changed into a reduced pressure state the interior and dipped in liquid crystal material, next nitrogen etc. is introduced into a chamber and the pressure inside a chamber is made high The difference of the internal atmospheric pressure of an empty cell and the atmospheric pressure in a chamber is absorbed and filled up with liquid crystal material in an empty cell. For example, it is proposed by the Provisional-Publication-No. 62-No. 89025 official report.
[0004] However, according to this method, when creating a large-sized liquid crystal panel, the purge timing for making the inside of a chamber into a vacuum starts for a long time. Moreover, in order to dip an empty cell, required hatchet cost becomes [a lot of liquid crystal material] high. Moreover, it takes the time and effort which closes opening after liquid crystal enclosure, and the time and effort which washes the liquid crystal adhering to the circumference of opening. On the other hand, the vacuum dropping pouring-in method has many advantages. Drawing 6 is the perspective diagram having shown roughly the closure process of the liquid crystal broken into the vacuum dropping pouring-in method, and is drawing 6 (a). - (c) It is each process, respectively.
[0005] Drawing 6 (a) It adheres to the sealant 22 which consists of an optical hardening type resin on the first substrate 21 which formed the pixel electrode, the TFT element, the orientation film, etc. then in the shape of a frame. Moreover, liquid crystal 23 is dropped inside the frame of this sealant 22. Moreover, the transparent electrode and the orientation film are formed also in the second substrate 24, and the field by the side of the transparent-electrode formation counters the pixel electrode forming face of the first substrate 21. On the orientation film of the second substrate 24, the spacer (not shown) is sprinkled uniformly. This spacer is an almost spherical particle with a diameter of several micrometers which consists of a resin etc., and when the first and the second substrate 21 and 24 are made to rival, it is used in order to make uniform the gap between substrates 21 and 24 (gap) over the whole panel.
[0006] Next, drawing 6 (b) The second substrate 24 which adhered the spacer to the first substrate 21 which trickled liquid crystal 23 is piled up in a vacuum so that it may be shown. And a sealant 22 touches the second substrate 24, and if the circumference is made into atmospheric pressure from a vacuum, the first and the second substrate 21 and 24 can draw near according to the atmospheric pressure difference of cell inside and outside in the place where a closed space was formed with the frame of a sealant 22 between the first and the second substrate 21 and 24. Liquid crystal 23 spreads in a longitudinal direction between the first and the second substrate 21 and 24 at a radial as the first and second intervals of the electrode substrates 21 and 24 narrow at this time.
[0007] Thereby, it is drawing 6 (c). It fills up with liquid crystal 23 within the limit of the sealant 22 between the first and the second substrate 21 and 24 completely so that it may be shown. Here, the gap between the first and the second

substrate 21 and 24 is equalized over the whole panel by the spacer. Moreover, re-alignment for doubling precisely the mutual position of the first and the second substrate 21 and 24 on pixel level at this time is performed. This is performed by moving the first substrate 21 or the second substrate 24 to a longitudinal direction. If re-alignment is completed, ultraviolet rays will be irradiated, a sealant 22 will be stiffened and closure of liquid crystal will be completed.

[0008]

[Problem(s) to be Solved by the Invention] However, there were the following troubles by the manufacture method of such a liquid crystal display panel. First, in case liquid crystal is dropped at one substrate and two substrates are stretched, the rapid flow of liquid crystal arises between two substrates. Therefore, the spacer made to adhere uniformly beforehand moved by the rapid flow of liquid crystal, and it spread in the radial from the center of a panel, and it might incline annularly and might incline near the sealant of a panel edge. Thus, when unevenness arose in the spacer distribution, the gap between substrates in a panel side becomes uneven, and the performance of a liquid crystal panel might be reduced.

[0009] Moreover, depending on the relation between the diameter of a spacer, and gap ** between substrates, the spacer and the substrate front face might contact more strongly than required. For this reason, when moving a substrate for re-alignment, the substrate front face was contacted strongly, the orientation film and the electrode layer might be damaged or the spacer might bar movement of a substrate. moreover -- the time of filling up the cell between substrates with liquid crystal -- closure -- although carried out using the pressure differential of the inside of the frame of a member, and an outside, since a closure member was still in a soft state by un-hardening when filled up, the crack might arise in the closure member with the pressure, and poor closure might occur

[0010] the closure which drawing 7 showed the liquid crystal display panel which such poor closure generated, and was inserted into the first and the second substrate 21 and 24 -- two kinds of cracks 22a and 22b have arisen in the member 22 one crack 22a -- closure -- the time of the inside of the frame of a member 22 being a vacuum -- closure -- it is generated from the outside of the frame of a member 22 with the pressure of the atmosphere which works inside Crack 22b of another side is produced from the inside of a frame 22 in many cases by the pressure of the liquid crystal material 23 and the compatibility of liquid crystal and a sealant which work outside. closure -- if such cracks 22a and 22b arise in a member 22, liquid crystal material will leak from a cell, or air will enter in a cell, and the display property of a liquid crystal display panel will be reduced

[0011] Moreover, there is contamination of liquid crystal as one of the factors related to the display performance of a liquid crystal display panel. It can ask for contamination of this liquid crystal by measuring the voltage retention between the counterelectrodes which sandwich liquid crystal. The capacity to maintain the potential difference of a counterelectrode is so high that this voltage retention is high, and the capacity to drive liquid crystal is high. closure -- a member -- the graph of drawing 8 measured change of the voltage retention by the time of irradiation of the ultraviolet rays for hardening at the center and edge of a liquid crystal display panel this graph -- a horizontal axis -- UV irradiation time and a vertical axis -- the voltage retention of liquid crystal -- it is -- the line of a graph -- A -- the center of a display panel, and B -- closure of a display panel -- a member -- it is a nearby thing although it hardly changes even if the voltage retention of the liquid crystal of a liquid crystal display panel center section irradiates ultraviolet rays for a long time, as this graph shows -- closure of a liquid crystal display panel -- a member -- the voltage retention of nearby liquid crystal is falling, so that UV irradiation time becomes long In addition, UV irradiation conditions were performed within the limits of a maker's recommendation conditions.

[0012] this -- ultraviolet rays -- closure -- a member -- when near liquid crystal irradiates, it is for liquid crystal and a closure member reacting, and the resultant's melting into liquid crystal, and polluting liquid crystal contamination of this liquid crystal -- closure -- a member -- although generated in near, it spreads with the passage of time and the performance of the whole liquid crystal display panel is reduced In case this invention is made in view of such a conventional trouble and liquid crystal is closed between substrates by the vacuum dropping pouring-in method Distribute a spacer uniformly over the whole liquid crystal panel, equalize the gap between substrates, and the display performance of a liquid crystal display panel is raised. Moreover, while preventing the injury on the substrate side by the spacer, it aims at offering the manufacture method of the liquid crystal display panel which makes movement of the substrate for re-alignment easy.

[0013] furthermore, the time of this invention closing liquid crystal between substrates by the vacuum dropping pouring-in method -- closure -- the poor closure by the crack initiation of a member is prevented, and it aims at offering the manufacture method of the liquid crystal display panel which can improve the yield of a liquid crystal display panel furthermore, this invention -- closure -- a member -- contamination of the liquid crystal produced by irradiation of the ultraviolet rays for hardening is reduced, and it aims at offering the manufacture method of the liquid crystal display panel which can improve the display performance of a liquid crystal display panel

[0014]
[Means for Solving the Problem] The process which applies a sealant 2 to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates 1 and 4 of a couple so that the above-mentioned technical problem may be illustrated to drawing 1 , The process which makes the particle 5 which has 0.2-0.6 micrometers or a path small 4 to 12% to the liquid crystal layer thickness which it is going to form and control among the substrates 1 and 4 of the aforementioned couple adhere and fix to the field by the side of one electrode formation of the substrates 1 and 4 of the aforementioned couple, The process which trickles the liquid crystal material 3 on the field by the side of the aforementioned electrode formation surrounded by the aforementioned sealant 2, The field by the side of each electrode formation of the substrates 1 and 4 of the aforementioned couple is made to counter, and it piles up under reduced pressure, and solves by the manufacture method of the liquid crystal display panel characterized by having the process which extends the aforementioned liquid crystal material 3 and forms the aforementioned liquid crystal layer among the substrates 1 and 4 of the aforementioned couple.
[0015] Or the aforementioned particle is solved by the manufacture method of the aforementioned liquid crystal display panel characterized by being covered with adhesives and fixed to the field by the side of aforementioned one electrode formation. Or the process at which viscosity applies the sealant 2 of 50000 or more cps to the field by the side of one [at least] electrode formation in the shape of a frame among the substrates 1 and 4 of a couple, The process which trickles the liquid crystal material 3 into the field by the side of the aforementioned electrode formation surrounded by the aforementioned sealant 2, The field by the side of each electrode formation of the substrates 1 and 4 of the aforementioned couple is made to counter, and it piles up under reduced pressure, and solves by the manufacture method of the liquid crystal display panel characterized by having the process which extends the aforementioned liquid crystal material 3 and forms the aforementioned liquid crystal layer among the substrates 1 and 4 of the aforementioned couple.
[0016] Or the process which forms doubly at least the frames 2a and 2b which consist of a sealant 21 along this field on the field by the side of one [at least] electrode formation among the substrates 1 and 4 of a couple, The process of the aforementioned sealant by the side of electrode formation of the aforementioned substrates 1 and 4 which trickles the liquid crystal material 3 in inside frame 2a most, The field by the side of each electrode formation of the substrates 1 and 4 of the aforementioned couple is made to counter, and it piles up under reduced pressure, and attains by the manufacture method of the liquid crystal display panel characterized by having the process which extends the aforementioned liquid crystal material 3 and forms the aforementioned liquid crystal layer among the substrates 1 and 4 of the aforementioned couple.
[0017] Or after closing the aforementioned liquid crystal material 3, it solves by the manufacture method of the aforementioned liquid crystal display panel characterized by leaving and excising the No. 1 [at least] inside of the frames 2a and 2b which consist at least one side of the substrates 1 and 4 of the aforementioned couple of the aforementioned sealant. Or the frame which consists of an optical hardening type sealant 2 is applied to the field by the side of one [at least] electrode formation of the substrates 1 and 4 of a couple so that it may illustrate to drawing 1 and drawing 3 . The process which trickles the liquid crystal material 3 into the field by the side of the aforementioned electrode formation surrounded by this frame that arranges the shading means 8 near the inside of this frame, and consists of this sealant 2, It solves by the manufacture method of the liquid crystal display panel characterized by having the process which the field by the side of each electrode formation of the substrates 1 and 4 of the aforementioned couple is made to counter, and is piled up under reduced pressure, and the process which light is irradiated [process] at the aforementioned sealant 2 and stiffens this sealant 2.
[0018] Or drawing 2 (a) It solves by the manufacture method of the aforementioned liquid crystal panel characterized by dropping the aforementioned liquid crystal material 3 using the dispenser which has the liquid crystal feed holes 13 to the down side, and has the needle 14 which is arranged in the liquid crystal material container 11 with which an internal pressure is maintained uniformly, and this liquid crystal material container 11, and opens and closes these liquid crystal feed holes 13 so that it may illustrate.
[0019]
[For **] According to this invention, when an overall diameter carries out adhesion fixation of 0.2-0.6 micrometers or the particle small covered by the binder 4 to 12% at one substrate at least than the liquid crystal layer formed in the inside of the substrate of the couple which constitutes a liquid crystal display panel, movement of the substrate for performing re-alignment can be ensured, without damaging a substrate inside. This is having checked experimentally.
[0020] Moreover, a particle can be made to adhere to a substrate certainly by forming the frame of a sealant in the electrode formation side of a substrate, making a particle with adhesives adhere inside the substrate which counters, dropping liquid crystal within the limit of a sealant, and closing liquid crystal under reduced pressure. Therefore, a particle is passed by the rapid liquid crystal flow at the time of being filled up with liquid crystal between substrates

etc., it can prevent inclining and distributing a particle on a substrate, and the homogeneity of ****** between the substrates in a panel side can be raised. Since especially the particle of the above-mentioned path is easy to pass, there is wrap need in this particle with adhesives.

[0021] Moreover, since it is hard coming to damage a sealant by viscosity's adhering the sealant of 50000 or more cps to the electrode formation side of a substrate in the shape of a frame, dropping liquid crystal within the limit, and closing by reduced pressure-ization to external force, poor closure of the sealant at the time of being filled up with liquid crystal between substrates can be reduced. Moreover, the frame of a sealant is doubly prepared in the electrode formation side of a substrate at least along the direction of a substrate flat surface, the pressure differential of sealant inside and outside at the time of enclosing liquid crystal by [of the frame] dropping liquid crystal inside most and closing under reduced pressure is eased, and generating with poor closure can be reduced. Moreover, by [of the frame of a sealant] leaving the inside most at least and removing a substrate, finally an unnecessary closure frame is removed and a liquid crystal display panel is simplified.

[0022] Furthermore, contamination of the liquid crystal which liquid crystal and a sealant react and produce can be prevented by irradiating ultraviolet rays by establishing a shading means near the inside of the frame of an optical hardening type sealant to which it adhered at the electrode formation side of a substrate, dropping and enclosing liquid crystal material within the limit of a sealant, irradiating ultraviolet rays, and stiffening a sealant. Thereby, the display performance of a liquid crystal display panel can be raised.

[0023] Dropping of the liquid crystal material in this invention is using the dispenser opened and closed with a needle. According to this, drip could be made uniform with high degree of accuracy, and, moreover, it was checked experimentally that repeatability is good.

[0024]

[Example] Then, the example of this invention is explained based on a drawing below.

(The 1st example) Drawing 1 (a) - (e) It is the cross section showing roughly the manufacture method of the liquid crystal display panel concerning the 1st example of this invention.

[0025] In those drawings, although the first substrate 1 consists of glass etc., transparent electrodes and orientation films, such as ITO, are formed in the whole surface in fact, patterning of the circuits, such as a TFT element and a bus line, is carried out further and liquid crystal is supplied on the TFT element etc., a transparent electrode, TFT, etc. are omitted drawing, in order to clarify explanation. First, drawing 1 (a) The sealant 2 which consists of an ultraviolet-rays hardening type resin etc. is formed in the field by the side of electrode formation of the first substrate 1 in the shape of a frame, and the liquid crystal 3 of the specified quantity is dropped by the well-known method inside the frame of a sealant 2 so that it may be shown. Moreover, the field where liquid crystal 3 was dropped among the first substrate 1 counters the adhesion side of the spacer 5 of the second substrate 4, and is arranged.

[0026] The second substrate 4 consists of transparent materials, such as glass and a quartz. Moreover, although the black matrix, the light filter, the common transparent electrode, and the orientation film are formed in the side which counters the first substrate 1 among the second substrate 4 in order, they are omitted in order to simplify explanation. Next, the sealant and spacer which were adopted by this example are explained.

[0027] (sealant) It is important to choose the sealing material of suitable viscosity so that a sealant 2 is for example, UV hardening type, and serves as adhesives of the first and the second substrate 1 and 4 at a next process, it may be for dividing the space which moreover encloses liquid crystal 3 between substrates and a sealant 2 may not cause poor closure by the pressure differential of cell inside and outside in the case of restoration of liquid crystal 3.

[0028]

[Table 1]

封止材粘度(cp)	10,000	20,000	50,000	100,000
封止不良 (%)	40	80	2	0

[0029] Table 1 is a table having shown the relation between the viscosity of a sealant, and a closure percent defective. The incidence rate with a closure percent defective very high when the viscosity of a sealant is 20,000 or less cps as this table shows, and a sealant poor [the viscosity] in 50,000 or more cps is a low very much. Therefore, it is desirable that viscosity uses the material of 50,000 or more cps as a sealant 2.

[0030] (spacer) On the orientation film by the side of the second substrate 4 (un-illustrating), uniformly, the spacer 5 is sprinkled and it adheres to it. A spacer 5 is the particle of a uniform size and consists of almost spherical plastics etc. When the path of a spacer 5 pastes up the first and the second substrate 1 and 4 by the sealant 2, it is decided to make uniform liquid crystal layer thickness between substrates over the whole. Moreover, the path of a spacer 5 must also take into consideration not barring substrate movement in the case of the re-alignment of the first performed at a next

process, and the second substrate 1 and 4.
[0031]
[Table 2]

液晶厚（μm）	4.8	5.0	5.2	5.4	5.6	5.8
基板の移動	不可	不可	可	可	可	可
液晶厚ムラ（μm）	±0.1	±0.1	±0.1	±0.1	±0.1	±0.15

[0032] Table 2 is a table in which the difference of ****** between substrates and the diameter of a spacer showed how it would be related to movement of a substrate, and liquid crystal thick nonuniformity. Liquid crystal thick nonuniformity shows the error of the liquid crystal layer thickness actually formed between substrates. Here, when a diameter changes the liquid crystal layer thickness of the first and the second substrate 1 and 4, using the 5 micrometers (product made of Hayakawa rubber) spacer 5, the liquid crystal thick nonuniformity in the whole state and whole panel of substrate movement by substrate re-doubling is shown. The examination of movement here of a substrate was performed by fixing one substrate by the vacuum chuck, fixing the substrate of another side by another vacuum chuck, and applying the 50kg force to a longitudinal direction.
[0033] When ****** was 5.0 micrometers or less about movement of a substrate so that clearly from Table 2 that is, it was the same as the diameter of a spacer, or movement of a substrate was impossible when smaller than it. On the other hand, liquid crystal thickness was able to move in 5.2 micrometers or more. About liquid crystal thick nonuniformity, ****** became large by 5.8 micrometers and it turns out by 5.6 micrometers or less that it is changeless.
[0034] If these are taken into consideration, when a diameter will use the spacer which is 5 micrometers, it is desirable to set liquid crystal thickness to 5.2-5.6 micrometers. That is, the greatest diameter of a spacer is understood that it is more desirable than the liquid crystal layer thickness between substrates to make it small 0.2-0.6 micrometers. That is, the thing of the liquid crystal layer thickness between substrates and the path of a spacer large about 4 to 12% is desirable. Then, in this example, the thing with a diameter of 5 micrometers was used for the spacer 5, and ****** between the first and the second substrate 1 and 4 was set to 5.2 micrometers.
[0035] By the way, in order to make a spacer 5 adhere to the front face of the second substrate 4, the method of mixing a spacer 5 with a solvent etc. and spraying on the front face of the second substrate 4 in 80-90-degree C atmosphere is adopted. According to this method, before a spacer 5 reaches the second substrate 4, a solvent evaporates and only a spacer 5 adheres to the front face of the second substrate 4 in the state of a grain. At this time, the front face of the second substrate 4 adheres to a spacer 5 by adsorption [be / chemical / static electricity-/ it]. As other spacer adhering methods, a dry atomizing process etc. is sufficient.
[0036] Moreover, it is desirable to use as a spacer the spacer with which the coat of adhesives was formed in the front face, for example. It can prevent the second substrate's 4 adhering to a spacer 5 certainly by this, pouring a spacer 5 by the liquid crystal flow etc., and a distribution of a spacer 5 becoming uneven. Therefore, the homogeneity of the liquid crystal layer thickness of the whole liquid crystal panel improves.
[0037] To say nothing of being what is produced by being fixed by the strength of the grade to which a spacer can resist the flow of liquid crystal, or more than it, such an effect does not necessarily need to carry out coat processing of the front face with adhesives. For example, naturally also in the spacer which processed and formed the bank which has the same level difference as the diameter of a spacer, an effect is produced.
[0038] At this example, in order to make the spacer (product made of Hayakawa rubber) covered by adhesives adhere to the front face of the second substrate 4, heat treatment for 30 minutes was performed to adhesion processing of the conventional spacer at 150 degrees C. Thus, after having formed the sealant, adhering the spacer and making the first and the second substrate 1 and 4 rival, it is drawing 1 (b). The cell 6 between the first and the second substrate 1 and 4 is filled up with liquid crystal 3 so that it may be shown.
[0039] When filled up with the liquid crystal, the second substrate 4 is carried and pressed down on the first substrate 1 by which liquid crystal 3 was trickled into the vacuum in those substrates 1 and 4, and atmosphere is returned to atmospheric pressure from a vacuum in the place which the sealant 2 stuck with the front face of the second substrate 4. Since the interior of the cell 6 closed by the sealant 2 is a vacuum and the outside of a cell 6 becomes atmospheric pressure at this time, by the pressure differential, the second substrate 4 can be drawn near to the direction of the first substrate 1, and liquid crystal 3 spreads along the field of the first and the second substrate 1 and 4 as a result.
[0040] In this case, since liquid crystal 3 spreads inside a cell rapidly when returning a surrounding atmosphere to atmospheric pressure, although a rapid flow arises in liquid crystal 3, since the spacer with adhesives is used, it is washed away by the spacer 5 at the flow of liquid crystal 3, a spacer distribution does not incline, and a spacer 5 can be

maintained in the state where it was distributed uniformly at this example. Moreover, although there is a big atmospheric pressure difference in a cap's 6 the inside and outside at this time and a sealant 2 receives a big pressure, poor non-hardened hatchet closure still tends to produce a sealant 2. However, in this example, since viscosity is using the material of 50,000cp(s) as a sealant 2, with the pressure, it is hard coming to receive an injury and generating with poor closure can be reduced sharply.

[0041] When the state where the gap 6 between the first and the second substrate 1 and 4 was completely filled up with liquid crystal 3 is shown, it is drawing 1 (c). Becoming like, the ****** becomes the predetermined value d. here -- liquid crystal -- thick -- d is 5.2 micrometers Although not shown in drawing in detail, the spacer 5 is not in contact with the first front face and homogeneity of a substrate 1 in fact. since it is not flatness and is irregular, since the orientation film made of a resin etc. is formed in each electrode formation side of the first and the second substrate 1 and 4, and the glass substrate itself has a curve further -- liquid crystal -- thick -- d becomes a bigger value than the diameter of a spacer 5

[0042] At this time, since the sealant 2 has not hardened, it shifts the position of the first substrate 1 or the second substrate 4, and performs re-alignment. This process is performed under atmospheric pressure. At this time, since the path of a spacer 5 is smaller than the liquid crystal layer thickness between the first and the second substrate 1 and 4 0.2 micrometers, mutual movement of the first and the second substrate 1 and 4 is not barred, and re-alignment can be performed easily and certainly.

[0043] After re-alignment and drawing 1 (d) Irradiate ultraviolet rays 7 by the high pressure mercury vapor lamp at a sealant 2, it is made to harden, and the first and the second substrate 1 and 4 are fixed so that it may be shown. next, drawing 1 (e) **** -- the portion outside the sealant 7 of the second substrate 4 is cut, and it removes with the unnecessary spacer 5 between the first in the exterior of a sealant 2, and the second substrate 1 and 4, and liquid crystal 3 Therefore, a liquid crystal display panel is simplified and it becomes easy to treat.

[0044] As mentioned above, at this example, by using a spacer with adhesives, a uniform distribution of a spacer can be maintained over the whole panel, and the work which took 1 hour or more in the 10 inch class conventionally is completed in several minutes. Moreover, substrate movement for the re-alignment of a substrate can be ensured now by using the spacer of a diameter smaller 0.2 micrometers than the liquid crystal layer thickness between substrates. Furthermore, as a sealant, since viscosity is using the sealing material of 50,000 or more cps, generating with poor closure can be reduced and the yield of a liquid crystal panel can be improved.

[0045] It is not necessarily easy to create a liquid crystal panel so that the above conditions may be fulfilled. Although the thing of the diameter of various kinds is marketed and it is easily available about the diameter of a spacer, it becomes [a constant rate and] change of jurisdiction about liquid crystal whether it is dropped with repeatability sufficient with high precision, and supplies with the point of this technology. the result in which this invention person did investigation examination using various dispensers -- electromagnetism -- an opening-and-closing formula nose-of-cam needle type thing -- best -- and it found out that only application was possible

[0046] Table 3 is the result of investigating precision about various dispensers.

[0047]

[Table 3]

名　　称	内　　容	精　度
ｴｱｰﾌｨｼｭﾙ 式	先端開状態でｴｱｰ 圧を変える	±２％以上
ﾁｭｰﾌﾞ（ﾛｰﾗﾎﾟﾝﾌﾟ）式	ﾁｭｰﾌﾞ中の液体をﾛｰﾙ で押す	±２％以上
電磁開閉先端ﾆｰﾄﾞﾙ式	常時一定圧力下でﾆｰﾄﾞﾙﾊﾞﾙﾌﾞ で開閉	±１％以下

[0048] electromagnetism -- the dispenser of an opening-and-closing nose-of-cam needle formula -- for example, drawing 2 (a) It has structure as shown. drawing 2 (a) it sets and the cap 12 on whom the point sharpened attaches in the soffit of the liquid crystal receipt machine 11 which contains liquid crystal 3 -- having -- the cap's 12 center -- dipping -- one hole 13 is formed moreover, a cap's 12 dipping -- on a hole 13, the needle 14 which can move up and down by electromagnetic arranges -- having -- the vertical movement -- the soffit of a needle 14 -- dipping -- the upper part of a hole 13 -- it is constituted so that a hole may be closed or opened Moreover, the interior of the liquid crystal receipt machine 11 is adjusted so that it may always become a constant pressure.

[0049] next, electromagnetism -- a liquid crystal dropping supply performance is shown in drawing using the dispenser of an opening-and-closing nose-of-cam needle formula For example, AKYURAJIETTA by the no boss was used. Moreover, liquid crystal used ZLI-4792 (Merck make). The size of 4 kgf/cm2 and a needle 14 of the internal pressure of the liquid crystal receipt machine 11 is 26G.

[0050] It is drawing 2 (b) about the relation between dispensing time (open time of a needle valve), and liquid crystal

drip, and the experimental result of the liquid crystal drip per unit time at each [of dispensing time] time. It is shown. According to this experiment, good linear relation is between dispensing time and liquid crystal drip, and the liquid crystal drip around unit time is fixed in a high precision.

[0051] next, electromagnetism -- when the precision and repeatability of liquid crystal drip accompanying the increase in the shots per hour of liquid crystal by the dispenser of an opening-and-closing nose-of-cam needle formula were examined, the result as shown in drawing 3 was obtained According to this, when the shot of the liquid crystal was continuously carried out 100 times in two days, the error of the amount of dispensers is less than **1%, and high degree of accuracy and high repeatability were obtained. In addition, similarly the conditions of the shot on the 1st and the 2nd were set up.

[0052] electromagnetism -- it turns out that it is suitable also for the dropping pouring-in method which trickles liquid crystal in vacuum atmosphere since a structure top is possible also for using the dispenser of an opening-and-closing nose-of-cam needle formula in a vacuum In addition, generally liquid crystal is dropped in atmospheric pressure.

(The 2nd example) A shading film is prepared in the inferior surface of tongue of the second substrate 4 which met the sealant 2 near the inside in order to prevent contamination of the liquid crystal 3 which prevents the reaction of the sealant 2 and liquid crystal 3 by ultraviolet rays 7, and is produced by the reaction in this example, and it is ********. The detail is given below.

[0053] Drawing 4 (a) The plan of the shading film 8 formed in the second substrate 4, and drawing 4 (b) It is the cross section. Drawing 4 (a) The shading film 8 formed in the background through the second then transparent substrate 4 is shown. The shading film 8 is the field which met inside the frame-like sealant 2, it is formed in the outside of a viewing area 9, and it is decided that it does not lap with a sealant 2 and a viewing area 9. If too near, since the formation field of the shading film 8 laps with a sealant 2, or the portion which is not hardened by the sealant 2 will arise, it is desirable to prepare few crevices between the shading film 8 and a sealant 2. Moreover, although the shading film 8 may be formed in the second substrate 4 bottom, its second substrate 4 bottom from the point of shading precision is more desirable.

[0054] If the shading film 8 carries out patterning of the film (for example, chromium film) which constitutes the black matrix film formed in the second substrate 4 and it is formed in order to raise display quality, it does not make a manufacturing process complicate. In order to stiffen a sealant 2, in case ultraviolet rays are irradiated, it is drawing 4 (b) to the exterior of the first and the second substrate 1.4. The shading mask [like] 10 is placed and the UV irradiation of a viewing area 9 is prevented. The shading field by the shading film 8 is because it is restricted between the viewing area 9 and the formation field of a sealant 2.

[0055] Moreover, although a shading film may be prepared in the first substrate 1 side when irradiating ultraviolet rays from the first substrate 1 side and stiffening a sealant 7, wiring of a bus line etc. is formed in the first substrate 1 with metals, such as aluminum, therefore, as for a shading film, forming with an insulating material is desirable. Thus, since ultraviolet dosage irradiated by the about two-sealant liquid crystal 3 by forming the shading film 8 can be lessened sharply, the reaction of the sealant 2 and liquid crystal 3 by UV irradiation can be reduced, and contamination of liquid crystal 7 can be lessened extremely. And with the external shading mask 10, the reaction of the liquid crystal in a viewing area and the minute amount molecule of a sealant 2 was prevented, and generating of contamination of liquid crystal 7 is suppressed.

[0056] As mentioned above, in this example, since it is made to prevent the UV irradiation of the liquid crystal near the sealant, contamination of the liquid crystal by the reaction of a sealant 2 and liquid crystal 4 is avoidable in the case of sealant hardening by UV irradiation. As described above, when it shaded and liquid crystal electric resistance was fallen by evaluation of voltage retention, using T-470 (a cationic polymerization type, the product made from the Nagase tiba, 100,000 cp) as a sealant, most decline in liquid crystal retention was not seen. In addition, as liquid crystal 3, ZLI-4792 (Merck make) is used and the irradiation conditions of the ultraviolet rays of a sealant 2 are 5000mJ/cm2. It carried out.

[0057] It becomes unnecessary in addition, to make ultraviolet rays into the shape of a beam, to irradiate only the frame-like sealant 2, and to use a shading film in this case.

(The 3rd example) Although the overall flow is the same as what explained the manufacture method of the liquid crystal display panel concerning the 3rd example of this invention in the 1st example, the formation methods of the sealant for closing two substrates which counter differ.

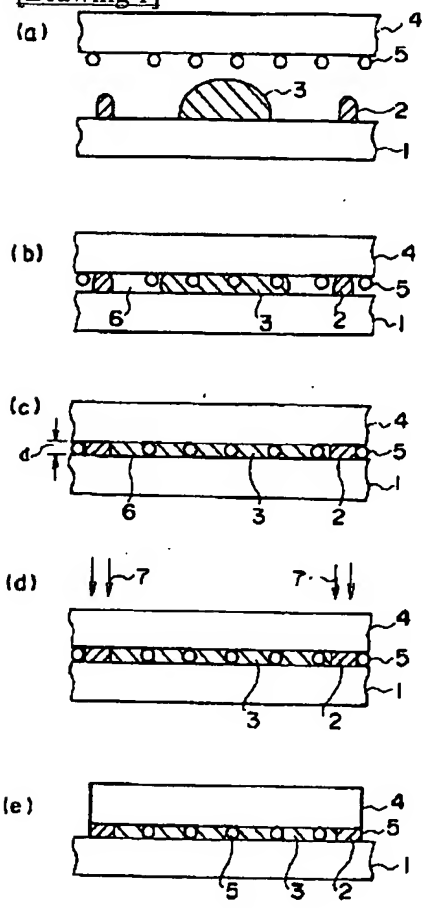
[0058] Drawing 5 (a) and (b) It is the plan and cross section of a liquid crystal display panel in the state where liquid crystal was enclosed. Drawing 5 (a) It sets, sealant 2b is formed in the outside of sealant 2a in a panel, and liquid crystal 3 is enclosed inside sealant 2a. The space between sealants 2a and 2b is a vacuum, and the outside of sealant 2b is the atmosphere. Before piling up the first and the second substrate 1 and 4, sealants 2a and 2b are made to adhere to the first substrate 1 in a vacuum, in order to form such double sealants 2a and 2b. And if the first and the second

substrate 1 and 4 are piled up, it pastes up and atmosphere is made into atmospheric pressure, the first and the second substrate 1 and 4 can draw near, and the interior of sealant 2a will be filled up with liquid crystal 3. Although the outside of sealant 2b becomes atmospheric pressure at this time, it is still a vacuum between sealant 2a and sealant 2b.
[0059] The inside of sealant 2a is a vacuum mostly until it fills up with liquid crystal 3 completely inside sealant 2a, in case surrounding atmosphere is made into atmospheric pressure and liquid crystal 3 is enclosed between substrates. However, it can change into the state where the outside of sealant 2a was also made into the vacuum, by preparing a sealant doubly in this way. Therefore, it can prevent a rapid pressure differential arising within and without sealant 2a, and generating with poor closure of sealant 2a can be avoided.
[0060] Moreover, after completing enclosure of liquid crystal 3 and stiffening sealant 2a at least, an outside [a / sealant 2/ of the second substrate 4] is cut and removed. Therefore, the material of sealant 2b is seldom limited, but can use various material. Thus, by preparing the frame of a sealant doubly, poor closure can be reduced and the yield of a liquid crystal panel can be improved.
[0061]
[Effect of the Invention] Like, according to this invention, form the frame of a sealant in the substrate which was described above and which has a transparent electrode etc., and liquid crystal is dropped at it within the limit. In the liquid crystal display panel which liquid crystal is enclosed [panel] between substrates and stiffens a sealant by piling up in a vacuum another substrate to which the spacer was made to adhere, and returning the circumference to atmospheric pressure, and its manufacture method By using what has a diameter smaller at least 0.2 micrometers than the liquid crystal layer thickness between substrates as a spacer, movement of the substrate in the case of re-alignment can be ensured, maintaining the homogeneity of the liquid crystal layer thickness between substrates.
[0062] Moreover, it can prevent pouring a spacer by the liquid crystal flow and a distribution of a spacer inclining by using a spacer with adhesives as a spacer. Thereby, the homogeneity of the liquid crystal layer thickness between the substrates over the whole panel improves. Moreover, when viscosity uses the thing of 50000 or more cps as a sealant, since a sealant becomes strong to external force, poor closure can be reduced. Furthermore, since the internal and external pressure differential of the frame which closes liquid crystal by preparing the frame of a sealant doubly can be eased, poor closure can be reduced. Thereby, the yield of a liquid crystal display panel can be raised.
[0063] Moreover, since contamination of the liquid crystal which liquid crystal and a sealant react by ultraviolet rays, and is produced by preparing a shading film near the sealant of a substrate can be prevented even when irradiating ultraviolet rays, in case it is made to harden as a sealant using an ultraviolet-rays hardening type material, the display performance of a liquid crystal display panel can be raised and stabilized. Since dropping of the liquid crystal material in this invention is using the dispenser opened and closed with a needle, it can equalize drip with high degree of accuracy, and, moreover, repeatability improves.

[Translation done.]

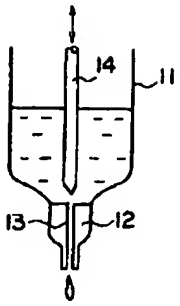
DRAWINGS

[Drawing 1]

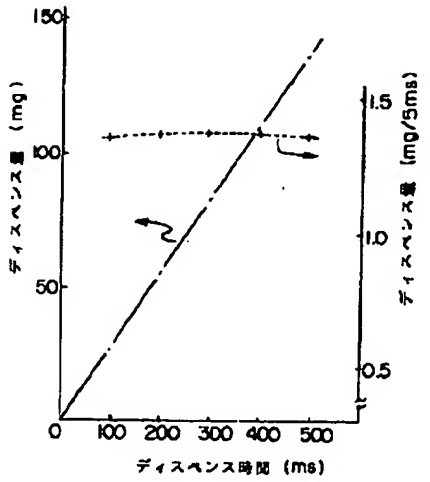


[Drawing 2]

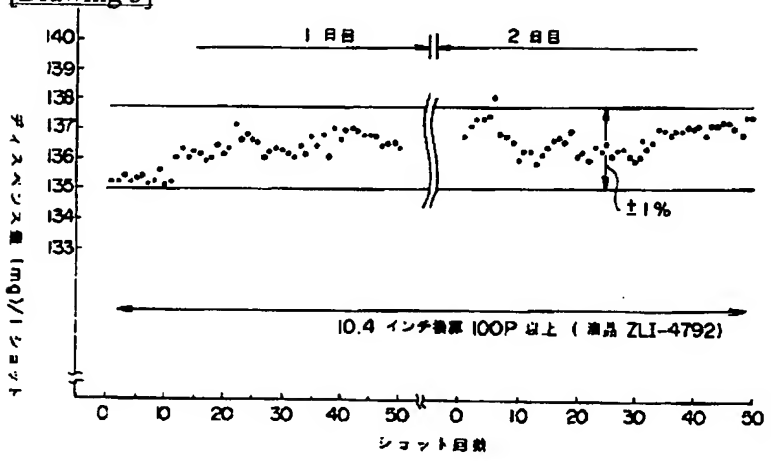
(a)



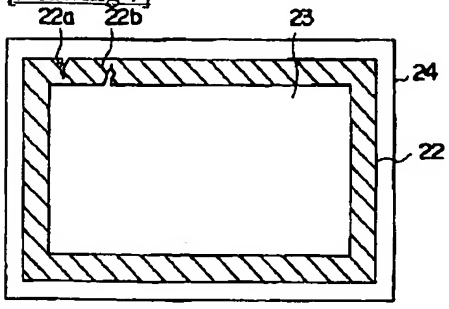
(b)



[Drawing 3]

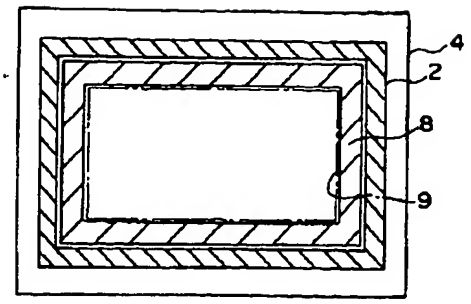


[Drawing 7]



[Drawing 4]

(a)



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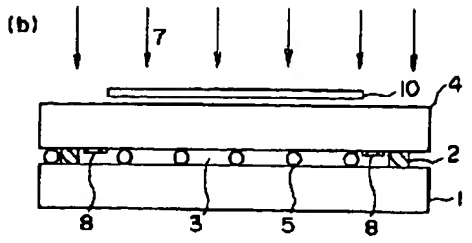
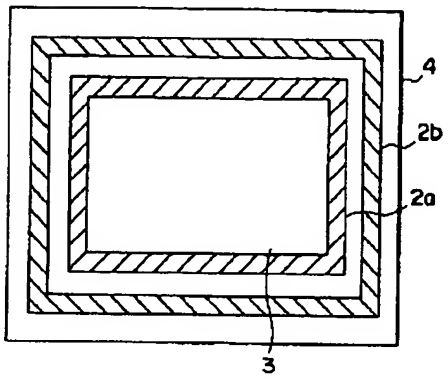
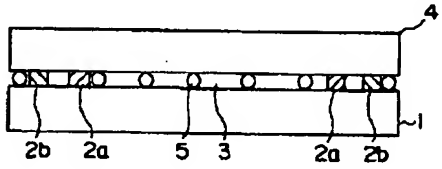


[Drawing 5]

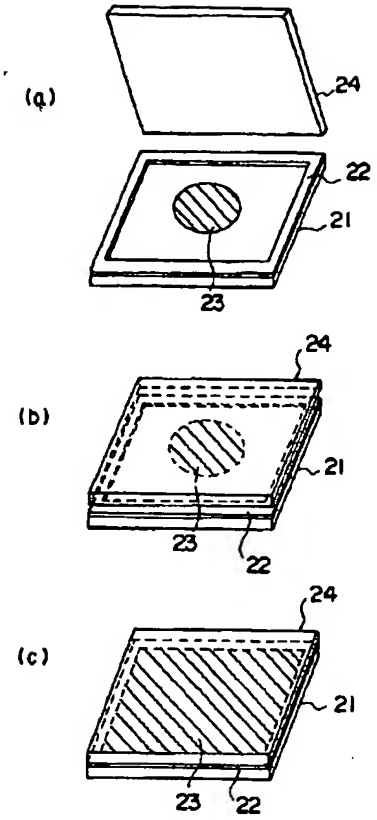
(a)



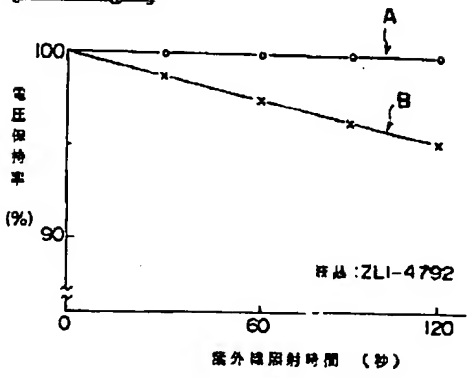
(b)



[Drawing 6]



[Drawing 8]



[Translation done.]